

CONNECTICUT

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Program Description

The Connecticut Ambient Biological Monitoring Program characterizes water quality by evaluating the biological integrity of resident communities of aquatic organisms. This information is used as the primary indicator to meet reporting requirements for assessment of aquatic life use support and impairment under Sections 305(b) and 303(d) of the Clean Water Act. There are currently about 3.5 full time employees dedicated to biological assessment of rivers. Biological monitoring has been conducted by the CT DEP Bureau of Water Management since the early 1970s and has focused primarily on the benthic invertebrate community of Wadeable stream segments. Narrative criteria for benthic invertebrates were incorporated into the CT water quality standards in 1987. Assessments are based on community structure characteristics using techniques intended to minimize the influence of variables such as habitat, seasonality and sampling method. Since 1989, methodology has followed a modified version of the USEPA Rapid Bioassessment Protocol (RBP) III (USEPA 1989).

A total of 302 sites on 153 rivers have been monitored to date (February 2002). Pursuant to the five-year rotating basin monitoring strategy that began in 1996, benthic invertebrate monitoring was conducted at approximately 50 sites each year for the five-year period ending in 2000. Since biological monitoring integrates environmental conditions over an extended time period, each site was sampled only once, primarily during the fall. Spring sampling is conducted on a limited basis for special studies or to supplement fall sampling. Sampling site selection is based on a targeted approach that considers sub-basin size, location of wastewater discharges, land use, and resource value. In addition to the rotating basin schedule, approximately ten regional reference sites located across the State are sampled annually, as well as a limited number of sites to support special projects.

The Bureau of Water Management recognizes the need to obtain a broader perspective of biological integrity by incorporation of fish community assessment data into the biological monitoring process. This has been accomplished to a limited degree by a cooperative working relationship with the CT DEP Division of Inland Fisheries. Fish sampling information obtained by fisheries biologists for purposes consistent with the fisheries management program has been utilized in the form of best professional judgment assessments which CT DEP considers to be generally equivalent to USEPA RBP IV (USEPA 1989). Funds obtained through an EPA 104(b)(3) grant have supported part of a Fisheries Division staff position since 1999. This effort has provided for approximately 24 fish community surveys, roughly equivalent in effort to annual RBP V assessment. This project is intended to support development of fish community structure metrics that will provide a more quantitative approach to the assessment process.

The CT DEP also promotes and directs a monitoring program for volunteers from which usable assessment information is obtained. The details of this program, *A Tiered Approach to Citizen-Based Monitoring of Wadeable Streams and Rivers*, can be obtained from the CT DEP Bureau of Water Management or viewed online at <http://dep.state.ct.us/wtr/volunmon/tierapp.pdf>

Section 305(b) of the CWA requires that states provide a description of the water quality of all navigable waters within their boundaries. Even with program improvements resulting from the rotating basin approach and incorporation of volunteer data, a complete census of State waters is not possible based on this focused approach to monitoring. To accomplish the goal of comprehensive monitoring, CT DEP is currently utilizing funds and technical assistance from USEPA to conduct a pilot statewide probabilistic monitoring program during 2002-2003. This project will sample the benthic invertebrate, fish, and periphyton communities at approximately 60 randomly selected sites. Through probabilistic monitoring, this statistically valid sample of Wadeable streams in Connecticut will provide an estimate of conditions of all Wadeable streams in the State. During this two-year period, the rotating basin approach will be suspended. However, limited focused monitoring will continue for reference sites, special projects, intensive surveys and to support TMDL development.

Documentation and Further Information

DRAFT 2002 List of Connecticut Waterbodies Not Meeting Water Quality Standards, 303(d) list, May 2002:
<http://dep.state.ct.us/wtr/wq/implist.pdf>

Draft Consolidated Assessment and Listing Methodology for 305(b) and 303(d) Reporting, April 2002:
<http://dep.state.ct.us/wtr/wq/method.pdf>

Quality Assurance Project Plan for Ambient Biological Monitoring, March 1996. CT DEP Bureau of Water Management, Planning and Standards Division, CT06106.

Beauchene, M. 2002. *Quality Assurance Project Plan, Ambient Biological Monitoring -- Fish Community Structure*. CT DEP Bureau of Water Management.

Ambient Monitoring Strategy for Rivers and Streams, Rotating Basin Approach. CT DEP 1999.

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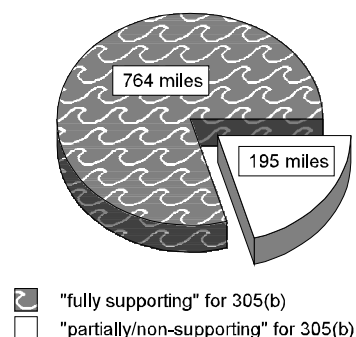
Programmatic Elements

Uses of bioassessment within overall water quality program	<input checked="" type="checkbox"/>	problem identification (screening)
	<input checked="" type="checkbox"/>	nonpoint source assessments
	<input checked="" type="checkbox"/>	monitoring the effectiveness of BMPs
	<input checked="" type="checkbox"/>	ALU determinations/ambient monitoring
	<input checked="" type="checkbox"/>	promulgated into state water quality standards as biocriteria
	<input checked="" type="checkbox"/>	support of antidegradation
	<input checked="" type="checkbox"/>	evaluation of discharge permit conditions
	<input checked="" type="checkbox"/>	TMDL assessment and monitoring
	<input type="checkbox"/>	other:
Applicable monitoring designs	<input checked="" type="checkbox"/>	targeted (i.e., sites selected for specific purpose) (<i>special projects, specific river basins and watersheds, and comprehensive use throughout jurisdiction</i>)
	<input checked="" type="checkbox"/>	fixed station (i.e., water quality monitoring stations) (<i>special projects, specific river basins and watersheds, and comprehensive use throughout jurisdiction</i>)
	<input type="checkbox"/>	probabilistic by stream order/catchment area
	<input checked="" type="checkbox"/>	probabilistic by ecoregion, or statewide (<i>comprehensive use throughout jurisdiction beginning in 2002 and 2003</i>)
	<input checked="" type="checkbox"/>	rotating basin (<i>comprehensive use throughout jurisdiction</i>)
	<input type="checkbox"/>	other:

Stream Miles

Total miles	5,830
<i>(State based determinations)</i>	
Total perennial miles	5,484
Total miles assessed for biology	961
fully supporting for 305(b)	764
partially/non-supporting for 305(b)	195
listed for 303(d)*	n/a
number of sites sampled*	311
number of miles assessed per site*	site specific

961 Miles Assessed for Biology



*The existing 303(d) doesn't use mileage, although it contains a subset of partially/non-supporting stream miles listed in the 305(b). These numbers will be the same in the next report. Of the 311 sites sampled, 221 were sampled by the state, 30 by contractors and 60 by volunteers. The number of miles assessed per site is site specific and varies according to land use, geomorphology, etc.

Aquatic Life Use (ALU) Designations and Decision-Making

ALU designation basis	Class System (A,B,C)	
ALU designations in state water quality standards	"Fish and Wildlife Habitat" is the only ALU designation, but narrative criteria are provided for "benthic invertebrates which inhabit lotic waters" for classifications AA, A, and B while more general descriptive narrative is provided for C and D.	
Narrative Biocriteria in WQS	Procedures used to support narrative biocriteria located in <i>SOPs for ambient biological monitoring</i>	
Numeric Biocriteria in WQS	none	
Uses of bioassessment data in integrated assessments with other environmental data (e.g., toxicity testing and chemical specific criteria)	<input checked="" type="checkbox"/>	assessment of aquatic resources
	<input checked="" type="checkbox"/>	cause and effect determinations
	<input checked="" type="checkbox"/>	permitted discharges
	<input checked="" type="checkbox"/>	monitoring (e.g., improvements after mitigation)
	<input checked="" type="checkbox"/>	watershed based management
Uses of bioassessment/biocriteria in making management decisions regarding restoration of aquatic resources to a designated ALU	Bioassessment/biocriteria have been used in specific cases to determine if formerly impaired waters are meeting ALU.	

Reference Site/Condition Development

Number of reference sites	12 total	
Reference site determinations	<input checked="" type="checkbox"/>	site-specific
	<input type="checkbox"/>	paired watersheds
	<input type="checkbox"/>	regional (aggregate of sites)
	<input type="checkbox"/>	professional judgment
	<input checked="" type="checkbox"/>	other: within major drainage basin
Reference site criteria	Least impacted by human influence. Size: \pm one stream order or one order of magnitude in drainage area with similar gradient.	
Characterization of reference sites within a regional context	<input type="checkbox"/>	historical conditions
	<input checked="" type="checkbox"/>	least disturbed sites
	<input type="checkbox"/>	gradient response
	<input type="checkbox"/>	professional judgment
	<input type="checkbox"/>	other:
Stream stratification within regional reference conditions	<input type="checkbox"/>	ecoregions (or some aggregate)
	<input type="checkbox"/>	elevation
	<input type="checkbox"/>	stream type
	<input type="checkbox"/>	multivariate grouping
	<input type="checkbox"/>	jurisdictional (i.e., statewide)
	<input checked="" type="checkbox"/>	other: major drainage basin, gradient
Additional information	<input type="checkbox"/>	reference sites linked to ALU
	<input type="checkbox"/>	reference sites/condition referenced in water quality standards
	<input checked="" type="checkbox"/>	some reference sites represent acceptable human-induced conditions

Field and Lab Methods

Assemblages assessed	<input checked="" type="checkbox"/>	benthos (<100 samples/year; single season, multiple sites - watershed level; multiple seasons, multiple sites - broad coverage for watershed level)
	<input checked="" type="checkbox"/>	fish (<100 samples/year; single season, multiple sites - broad coverage)
	<input checked="" type="checkbox"/>	periphyton (<100 samples/year; single season, multiple sites - broad coverage)
	<input checked="" type="checkbox"/>	other: phytoplankton and macrophytes (<100 sample/year; single season, multiple sites - not at watershed level)
Benthos		
sampling gear		Rectangular kick net, 1.5 ft. wide, 800-900 micron mesh. Surber and multiple plate samplers used prior to 1989. Rock baskets used for special projects.
habitat selection		richest habitat, riffle/run (cobble)
subsample size		200 count
taxonomy		benthic identification is primarily to species
Fish		
sampling gear		backpack electrofisher, pram unit (tote barge)
habitat selection		multihabitat
sample processing		length measurement, anomalies
subsample		none
taxonomy		species
Periphyton		
sampling gear		natural substrate: brushing/scraping device (razor, toothbrush, etc.)
habitat selection		riffle/run (cobble)
sample processing		chlorophyll <i>a</i> / phaeophytin; biomass; taxonomic identification; semi-quantitative field-based rapid periphyton survey
taxonomy		all algae, species level if possible
Habitat assessments		
		visual based; performed with bioassessments
Quality assurance program elements		
		standard operating procedures, quality assurance plan, periodic meetings and training for biologists, sorting and taxonomic proficiency checks, specimen archival

Data Analysis and Interpretation

Data analysis tools and methods	<input checked="" type="checkbox"/>	summary tables, illustrative graphs
	<input type="checkbox"/>	parametric ANOVAs
	<input type="checkbox"/>	multivariate analysis
	<input checked="" type="checkbox"/>	biological metrics (<i>aggregate metrics into an index</i>)
	<input type="checkbox"/>	disturbance gradients
	<input type="checkbox"/>	other:
Multimetric thresholds		
transforming metrics into unitless scores		Use scoring criteria table from 1989 Rapid Bioassessment Protocol (RBP) guidance (Figure 6.3-4). CT DEP recognizes the need to refine scoring criteria and impairment thresholds.
defining impairment in a multimetric index		Use biological condition table from 1989 RBP guidance (Figure 6.3-4): >54% of reference score = non-impaired for purposes of 305(b)/303(d)
Evaluation of performance characteristics	<input checked="" type="checkbox"/>	repeat sampling (<i>duplicate samples at reference sites</i>)
	<input type="checkbox"/>	precision
	<input type="checkbox"/>	sensitivity
	<input type="checkbox"/>	bias
	<input type="checkbox"/>	accuracy
Biological data		
Storage		Initial sample data is entered into an Excel spreadsheet then transferred to MS Access. Currently working on migration from MS Access to STORET.
Retrieval and analysis		Spreadsheet used for metric calculation. Formerly used SAS. Currently shopping for less expensive statistical package.

